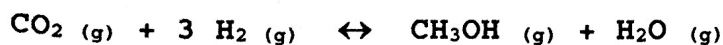


Manipulations of the Equilibrium Constant

1. Predict the equilibrium constant for:

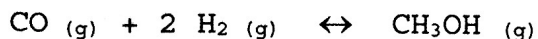


$$K_1 = ?$$

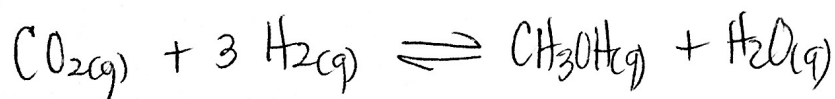
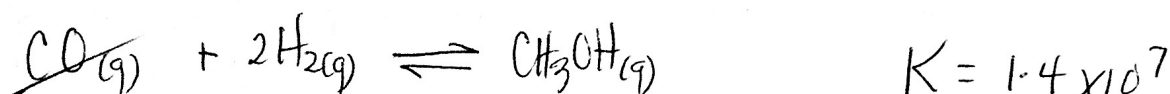
given the equilibrium constants for the following reactions.



$$K_2 = 1.0 \times 10^5$$

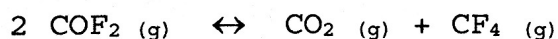


$$K_3 = 1.4 \times 10^7$$



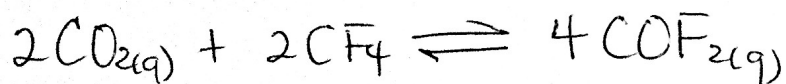
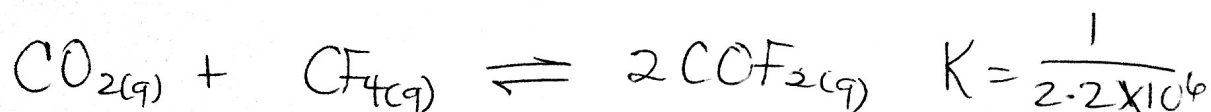
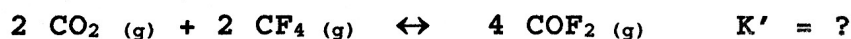
$$K = \left(\frac{1}{1.0 \times 10^5} \right) (1.4 \times 10^7) = \underline{140}$$

2. Consider the following chemical equation and equilibrium constant at 25 °C.



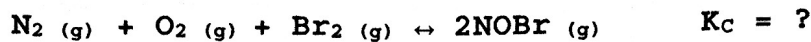
$$K_c = 2.2 \times 10^6$$

Compute the equilibrium constant for the following reaction at 25°C.

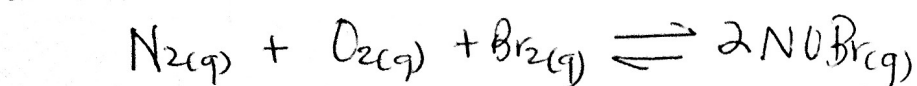
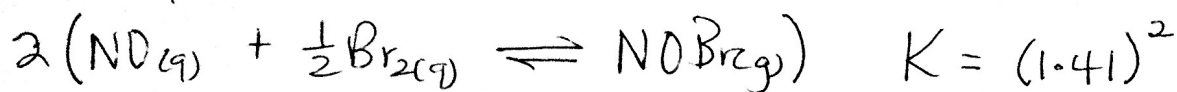
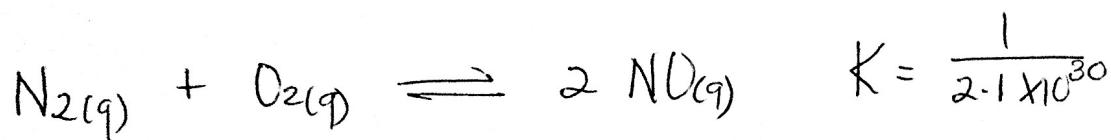
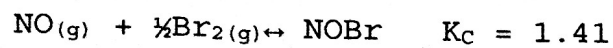
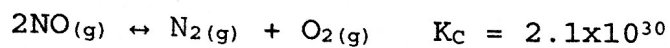


$$K = \left(\frac{1}{2.2 \times 10^6} \right)^2 = 2.1 \times 10^{-13}$$

3. Find K_c for the following reaction:



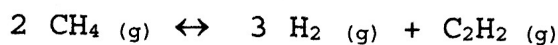
Use the following data to find K_c :



$$K = \left(\frac{1}{2.1 \times 10^{30}} \right) (1.41)^2 = 9.5 \times 10^{-31}$$

CHM129
The Equilibrium Constant

1. Consider the following reaction:



A mixture at 1700 °C initially contains $[\text{CH}_4]=0.115\text{M}$. At equilibrium, the concentration of C_2H_2 is 0.035M. What is the value of the equilibrium constant?

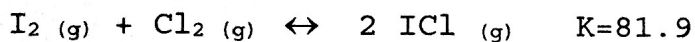
$$K = \frac{[\text{C}_2\text{H}_2] [\text{H}_2]^3}{[\text{CH}_4]^2}$$

$$K = \frac{(0.035)(0.105)^3}{(0.045)^2}$$

$$K = 0.020$$

	$[\text{CH}_4]$	$[\text{H}_2]$	$[\text{C}_2\text{H}_2]$
I	0.115	0	0
C	-0.070	+0.105	+0.035
E	0.045	0.105	0.035

2. Consider the following reaction and its equilibrium constant:



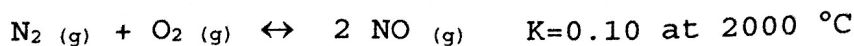
A reaction mixture contains $[\text{I}_2]=0.114\text{M}$, $[\text{Cl}_2]=0.102\text{M}$ and $[\text{ICl}]=0.355\text{M}$. Is the reaction mixture at equilibrium? If not, in which direction will the reaction proceed?

$$Q = \frac{[\text{ICl}]^2}{[\text{I}_2][\text{Cl}_2]} = \frac{(0.355)^2}{(0.114)(0.102)} = 10.8$$

$$Q < K$$

Rx runs right
(toward products)

3. Consider the following reaction:



A reaction mixture initially contains $[\text{N}_2]=0.200\text{M}$ and $[\text{O}_2]=0.200\text{M}$. Find the concentration of the reactants and the products at equilibrium.

	$[\text{N}_2]$	$[\text{O}_2]$	$[\text{NO}]$
I	0.200	0.200	0
C	-x	-x	+2x
E	0.200-x	0.200-x	2x

$$[\text{N}_2] = [\text{O}_2] = 0.200\text{M} - x$$

$$= 0.200\text{M} - 0.027\text{M}$$

$$= \underline{0.173\text{M}}$$

$$[\text{NO}] = 2x$$

$$= 2(0.027\text{M}) = \underline{0.054\text{M}}$$

$$K = \frac{[\text{NO}]^2}{[\text{N}_2][\text{O}_2]} = 0.10$$

$$\frac{(2x)^2}{(0.200-x)(0.200-x)} = 0.10$$

$$\sqrt{\frac{(2x)^2}{(0.200-x)^2}} = \sqrt{0.10}$$

$$\frac{2x}{0.200-x} = \sqrt{0.10}$$

$$2x = (0.200-x)\sqrt{0.10}$$

$$2x = (0.200)(\sqrt{0.10}) - \sqrt{0.10}x$$

$$0.063 = 2.3x$$

$$x = \underline{0.027\text{M}}$$